high above the church: the spire in such case is quite alienated. If an effect of greater grandeur be wanted, I would say—dispense with spire, and have a lofty and perpendicular tower; but, surmounted by a spire, the lower the tower the better must the whole be united, and conform to a general pyramidal outline.

Lanterns and spires, like those of St. Nicholas at Newcastle, and St. Dunstan's-in-the-East, London, are liable to great objection on these grounds. These steeples each present a pyramidal composition above, that has not the least connection with the body of the building. The high perpendicular tower on which they are placed cuts off all connection between them and the church, the composition of which they cannot at all aid; and they figure as a mere capping on a tower that is complete without them. Besides, there exists between them and the towers themselves no proper connection: there is, on their part, too great a disparity in size: they seem too small to have any real relationship to them. Such objects are, at least, fantastic and inappropriate in expression for a church; and, with their miniature windows and other features, have somewhat of a toy-like appearance. Their introduction is architectural daring, which is allowable only when the purpose is worthy of it.

Some architects go back to the original type of the spire, and finish the tower with a high-pitched and slated roof, showing eaves. These, however, having a roof character, cannot, I think, be carried beyond a certain very moderate height; as, for the mere purpose of throwing off rain, a pyramid approaching the proportion of the spire is ridiculous; whilst, kept low, the objection to such roofs is, that they present planes too nearly parallel with the planes of the main roof. Spires so elevated above all the roofs call for the extreme measure of the aspiring spirit, that they may form a climax with those below.

Not only in reference to spires, but to even spireless towers, are these principles to be kept in view. In many otherwise good designs, no composition has been aimed at that unites in one the church and tower, and embraces the whole into a harmonious group; the height of the latter being generally determined on without reference to the body of the church it adorns. But no good reason can be given why the laws of composition are here to be set aside. If the tower cannot be properly united to the church, then detach it at once like the Italian campanile.* S. H.

SANITARY ARCHITECTURE.

IN case your correspondent "D." who writes at the end of your current number, should be led, or lead any one else, to practise my "view" of ventulation with his "addendum," allow me to state some reasons against the addendum, which was neither overlooked in my view, nor omitted without thought.

First, his fundamental assumption that the respired breath (which he loosely calls "carbonic acid") will *ever* become like a "heavy palpable fluid" requiring *downward* drainage, is more than doubtful. Is he aware what is the utmost proportion of carbonic acid it ever contains? Not, I believe, a *fifteenth* even when just leaving us, before beginning that mixture with the surrounding air which must, before it has cooled, have irrecoverably diffused it; for he must remember that gases, however unequal in weight, never float one on another like water on mercury for many minutes or even *seconds*, but always *actively* mix by the action which Faraday has lately investigated under the name of "gaseous diffusion." For instance, two narrow-necked bottles or globes are filled, not the one with pure air and the other with breath (whose densities may be perhaps as 50 to 51), nor yet with air and carbonic acid (whose densities are as 2 to 3), but with carbonic acid and hydrogen, whose difference of weight is no less than as 20 to 1, or as great as between the very heaviest and lightest of liquids, between mercury and ether. They communicate only by a long narrow pipe with a stop-cock, and are placed with the heavy gas downward. Yet Faraday finds that, in a very few minutes, both globes contain only a perfectly equable mixture of the two gases: and this is hardly a minute longer in happening than if the hydrogen had been in the bottom instead of the top globe. There is nothing approaching this activity of intermixture in the case of *liquids*, even those that have chemical attraction for each other, as alcohol and water. They would be hours in mixing thoroughly under the above circumstances. Yet, place even *these* in the relations of the fresh and foul air, *i.e. reverse* their natural difference of weight by a sufficient difference of temperature, warm the water till it is lighter than cold alcohol, and though you may conceive it rising through the alcohol, as our breath through pure air, and even floating thereon, as hot milk on cold water, yet you would hardly expect it to remain unmixed not only long enough to cool down to the lighter fluid's temperature, but then to sink through it, and still maintain its separate condition at the bottom: would you? No, you would say, if only for the reason that in this cooling down from the state of being lightest to that of being heaviest, there must be a moment at which the hot fluid must be exactly *equal* in density to the cold one through which it is then beginning to descend. If "D." will try the experiment, I do not think he can, even with liquids, obtain this result, or make the milk (for instance) *first rise* through water because it is hotter, and *afterwards sink* through the same water because it is heavier. Of course, the experiment would not be fair with unmixable liquids, as *oil* and water, because we know of no gases analogous to this: all known gases are not only mixable, but mix actively, and when once mixed, never again separate mechanically.

Hence we see why, notwithstanding the constant production of carbonic acid, in so many ways, all over the earth's surface, it never drains down like a palpable fluid, as "D." supposes, or stagnates in depressions of the surface, except where *produced cold*, out of the ground itself, in mines and certain *extinct* volcanic places, or from cold ingredients in wells and sewers. All the general and necessary sources of this gas, animals, volcanoes, and artificial fires, send it forth hot enough to rise (from fires always, and from ourselves in all states of the temperate, and almost all states of the tropical atmosphere) out of our way, by its own temporary levity. And yet, by that same levity, and its subsequent cooling, it is more quickly diffused through the whole air, so as to be harmless to us and serviceable to vegetation, than it could be if either heavy from the first, like cold carbonic acid, or permanently light like hydrogen. Both these, observe, would pretty soon be thus mixed throughout, but not so quickly as the warm carbonic acid, which yet, by this exquisite adjustment, is, during the process of mixture, kept entirely out of our way.

Indeed, observation as well as theory seems to show that carbonic acid *once* heated enough to rise, does, from these causes, never sink again in the isolated form of choke-damp, or pollute any particular portion of air more than neighbouring portions, much less tend again to collect and drain downward. It is even found, I believe, that at great heights, whether on Mont Blanc, or attained by balloons over our plains, the air contains slightly *more* of this heavy ingredient than down here where it is being constantly produced (but also constantly absorbed by vegetation). Again, in the experiment of tapers burning in a confined space at different levels, the *upper* ones are the first extinguished.

We have no proof whatever, then, that even the almost *undiluted* carbonic acid from fires and lights, once raised by their heat, ever tends to drain downward, or be diffused in this direction more than others, either in the natural atmosphere, or *necessarily* in buildings. Of course in such needlessly unnatural circumstances as under our flat ceiling, it may and does, because every new warm breath, as it rises to that noxious plane, displaces and sends down the previous one that had just been spread out and cooled by it. Hence chemists find, in the air of our theatres, the natural order so exactly reversed that the air of the upper galleries, though much hotter, is, if there be any difference, rather *less* impure than that of the pit. A flat or undraining ceiling (such as all that we now use) plays battledoor and shuttlecock with our breath, bandies the carbonic acid up and down, and is the most effectual means that could possibly be contrived for thoroughly mixing it throughout the limited space of the *building only*; where it ought to be as quickly mixed throughout the *external air only*. And this, nothing but a ceiling expressly designed to do so can effect.

To show this quickly mixing and thoroughly polluting action of a flat ceiling, if the experiment of the tapers be tried in a space so covered, they will all go out *so nearly together*, that sometimes the highest, sometimes the lowest, may be first.

2ndly. But not only will carbonic acid that has once risen have no tendency to descend the proposed pipes—they will, unless many times larger or more numerous than any water-pipes, most needlessly obstruct the action; for observe, that the whole power by which *self*-ventulation is kept going must be derived from the current through the ceiling-vents. It is at the ceiling alone that any air is pressing to pass through from one space into another: it is there alone that the mere formation of the surface and opening of holes in proper places will be followed by a passage of air through them of its own accord, and constantly the same way; and this current must precede and cause all the others, must be the sole motive power, both to draw in behind it fresh air through the inlets near the floor, and to drive out before it the foul air that has already got above the ceiling. This order of causation (as I have shown in the appendix to the work whence this "view" was quoted) is of the utmost importance to remember. We can no more reverse it—no more make the entry of fresh air cause the exit of foul—than we can reverse the causation in a rope by which a steam-tug is towing a dead bulk, and say the hulk shall (still remaining behind) drive on the steamer by this same rope. The fresh air has neither tendency of itself to enter, nor, if it did, could it drive out the foul air, any more than a gill of water poured into a pint measure brim-full of a mixture containing a gill of wine, could drive out the wine. No mechanical power on earth can either *expel* or *extract* foul air from fresh. No power can rid you of it except its own levity, allowed to act *immediately* as it leaves you, before cooling or diffusion, and unchecked by one needless disturbance or obstacle. For, observe, this power is *only just* adequate to that effect, and it can receive no extraneous aid: no amount of steam-engines can either supply its place or do any portion of its work. Hence I have not scrupled to declare in the plainest terms, that everything in sanitation—*literally everything* depends on the right forming of the whole ceiling surface and its vents, and that *literally nothing* can remedy their wrong form. It grieves me, of course, in reading the late thick blue-book on this subject, to find how much trouble, time, and money have been sunk in the contest with an insuperable difficulty; but such a difficulty each foot of Sir Charles Barry's flat-ceiling planes presents. I do not mean to imply that the unity of a great work of consummate art springing from one mind and for one mind, should be broken in upon by such utilitarian vulgarities. No; let this mighty monument be finished and left to bear his name with *circumspice*. The senate-house for use may well be separated from that of ornament, and erected elsewhere (an expedient Mr. Bull has applied to almost everything else, and which solves many difficulties), but in this proposed second Westminster Palace, the alternative is plainly this,—if Sir Charles cannot Gothicise without flat-ceiling surface, Parliament CANNOT have what it desires,—two rooms retaining air of the same purity when the occupants leave as when they entered them. I do not touch the questions, observe, whether it is the office of architects and engineers to make difficulties or

* To be continued.